TRIP REPORT
VILLAGE SAFE WATER

REPORT DATE: June 21, 2005 **REPORTER:** Greg Magee, P.E., VSW

TRIP DATE: March 25, 2005

LOCATION: Emmonak, Alaska **PROJECT NO:** N/A

PURPOSE: Mechanical and Electrical Inspections and Follow-up Evaluation of the Foundation of the New Washeteria

Accompanied by: Cindy Roberts, Denali Commission
John Faschan, P.E., EDC (Electrical Engineer)
Kevin Hanson, P.E., EDC (Mechanical Engineer)
Brian Shumaker, P.E., Duane Miller & Associates

The main reasons for this one day trip were 1) to inspect and document the current conditions of the new washeteria's mechanical and electrical systems, including any code violations and operational problems and 2) observe and reevaluate the frost heave effects of the winter season on the foundation system. Attached are the reports from EDC (mechanical and electrical) and Duane Miller & Associates (geotechnical). The findings and recommendations from these reports will be used to develop a scope of work to restore functionality to the facility.

cc: Cindy Roberts, Denali Commission
Debra Addie, P.E., VSW
Kent Knapp, OAP

Duane Miller & Associates *Arctic & Geotechnical Engineering*
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Anchorage, Alaska 99518-3215
(907) 644-0510, fax 644-0507

April 29, 2005

State of Alaska
Department of Environmental Conservation
Division of Water / Village Safe Water
555 Cordova Street, 4th Floor
Anchorage, AK 99501-2617

Attention: Greg Magee, P.E., Program Manager

Subject: Additional Post-Construction Geotechnical Consultation
New Washeteria Building
Emmonak, Alaska
DM&A Job No. 4135.006

This letter presents our supplemental evaluation of the foundation system at the new washeteria building in Emmonak, Alaska. The work was performed in accordance with our agreement dated March 14, 2005. Mr. Brian Shumaker, P.E., of our office, initially observed the shallow soil and foundation support conditions during a site visit in October, 2004. The results of our initial observations indicated frost action has caused vertical movement of many of the piles supporting the washeteria. A discussion of the data and observations including recommendations for making the building useable were presented in a letter report dated December 17, 2004.

Mr. Greg Magee, P.E., Program Manager for Village Safe Water (VSW) arranged this additional site visit in support of efforts by VSW to develop a scope of work to restore functionality to the facility. On March 25, 2005, Mr. Shumaker traveled to Emmonak with Mr. Magee to reevaluate the building condition in general and specifically to observe the effects of the most recent winter season on the building's foundation system. Cindy Roberts of the Denali Commission, and John Faschan and Kevin Hanson of EDC Inc. also participated in the site visit.

We conducted a level survey of the bottom of the foundation beams at each of the pile support points throughout the building. The survey results are summarized in Table 1.

Table 1. Washeteria Exterior Level Survey Results†

Pile Location	Elevation (ft)	Pile Location	Elevation (ft)	Pile Location	Elevation (ft)
1.1	0.28	2.1	0.20	3.1	0.11
1.2	0.29	2.2	0.26	3.2	0.15
1.3	0.27	2.3	0.19	3.3	0.14
1.4	0.17	2.4	0.05	3.4	0.04
1.5	0.11	2.5	0.08	3.5	0.02
1.6	0.12	2.6	0.04	3.6	0.01
1.7	0.10	2.7	0.03	3.7	0.02
1.8	0.17	2.8	0.03	3.8	0.04
1.9	0.17	2.9	0.05	3.9	0.00

†All elevations are relative to the northwest building corner (Pile 3.9)

The survey results confirm variable displacements have occurred across the building. The distribution of individual pile displacements also closely matches the pattern seen from the data collected last fall. However, approximately one additional inch of displacement has occurred in the southeast corner and along the south perimeter piles relative to the northwest corner since the previous survey. The southeast corner is approximately 3 inches higher than the opposite (northwest) corner. The survey results are also shown on Plate 1.

Loose rocks and excessive granular fill were observed beneath the cross bracing and surrounding the piles at several locations along the building perimeter. We expect the damage to the bottom edges of the bracing, where observed, is attributable to the rocks engaging the bracing in the past as the surficial soils heaved due to seasonal frost action.

Up to six inches of ground surface movement associated with seasonal frost heave was indicated by several additional observations made during our visit. Annotated site photographs illustrating our observations are presented on Plates 2 through 6.

Conclusions and Recommendations

The survey results show additional differential vertical movement has occurred during the last winter season. The observed changes in differential floor elevations are consistent with the conclusions drawn in our previous report. We expect the relative displacements are attributable to continued upward movement of the piles subjected to localized frost heave forces.

Our initial recommendations were developed with the objective of relieving the potential for future vertical loading of the affected structural elements including the piles, cross-bracing and a utility enclosure at the southeast building corner. Repair and restoration work should be completed prior to the next winter season to avoid additional building displacements.

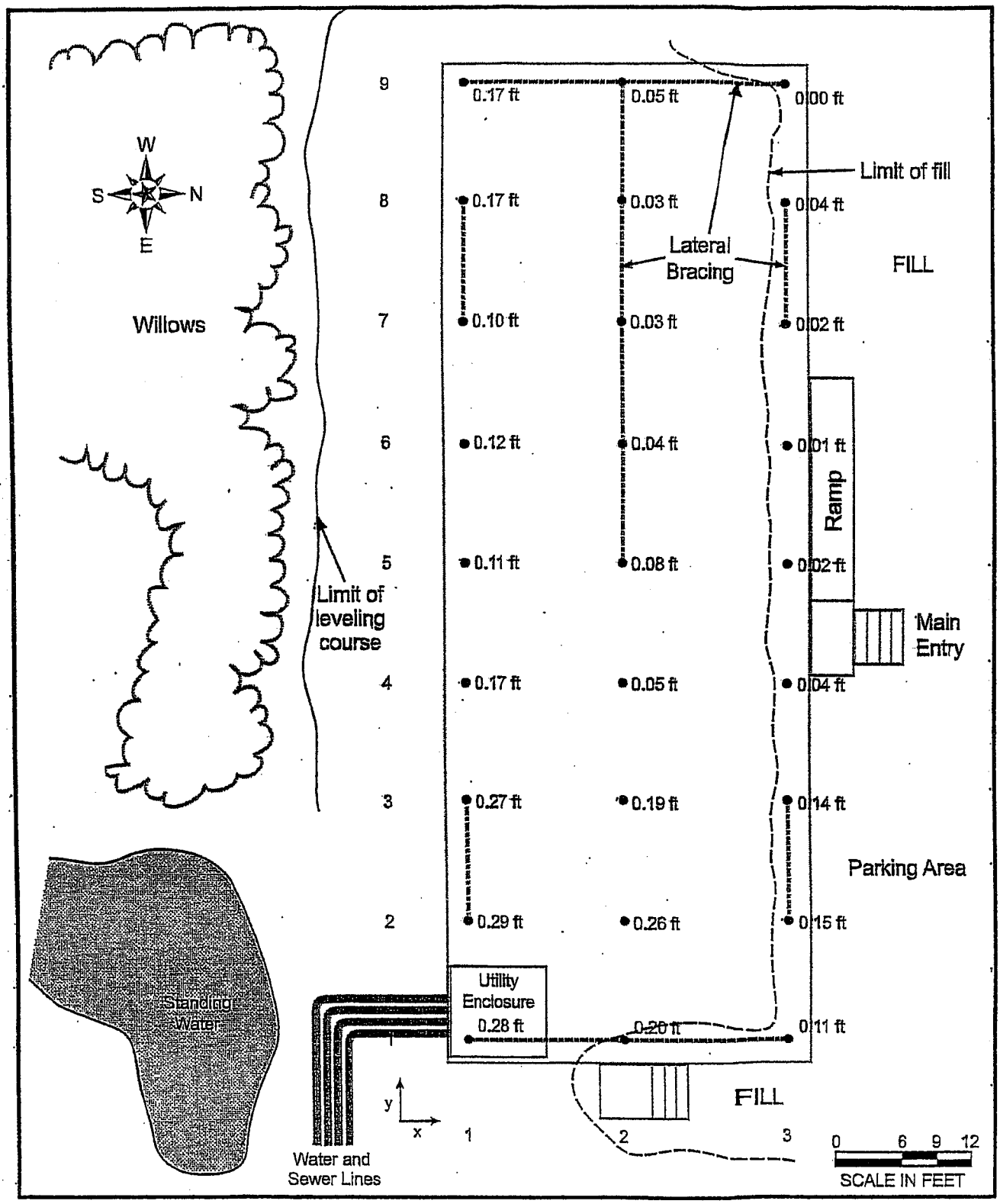
In addition to the recommendations of provided in our initial report, the building should releveled by a qualified contractor before the facility is placed in service.

Very truly yours,

Brian R. Shumaker, P.E.

BRS/DLM
cc: Cindy Roberts, Program Manager, Denali Commission

Attachments: Plate 1 Site Layout and Level Survey Results
Plates 2 through 6 Site Photographs



NOTES:
1. Exterior survey elevations are relative to the northwest building corner.
2. Reported elevations based on survey data collected March 25, 2005.

LEGEND

Figure 1 — Photograph Location and Direction

● — Pile Support

0.04 ft — Exterior Survey Relative Elevation

Duane Miller & Associates
Job No.: 4135.006
Date: April 2005

SITE LAYOUT and LEVEL SURVEY RESULTS
New Washeteria Building
Emmonak, Alaska

Plate 1

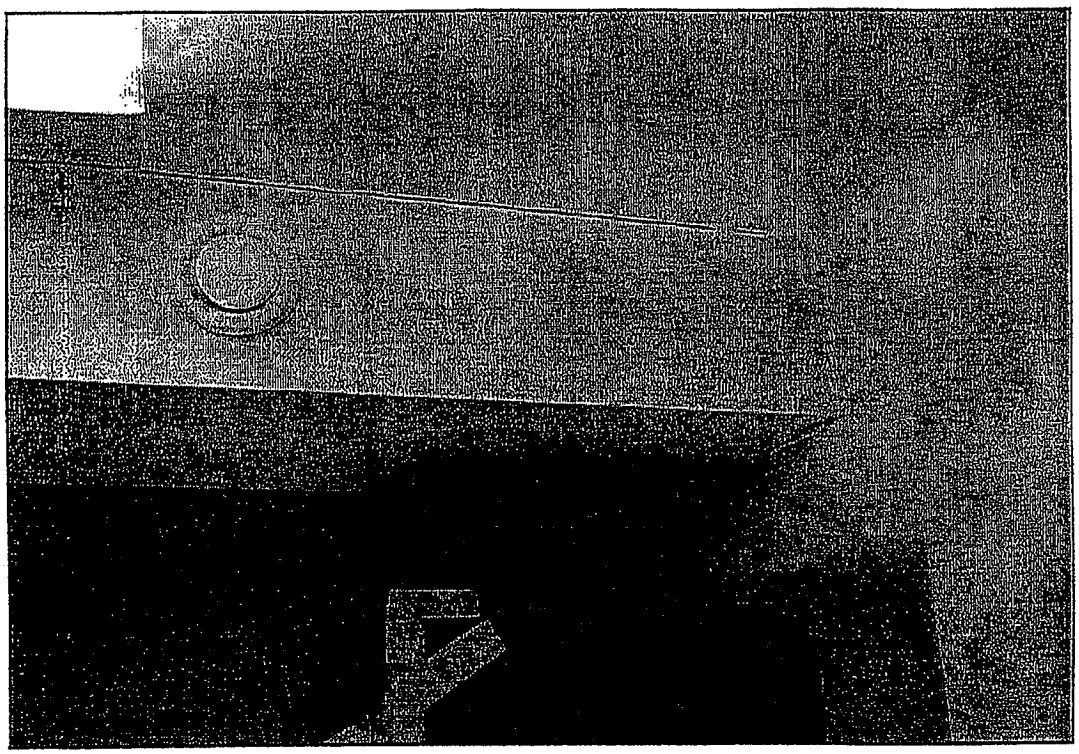


PHOTO 1. October 14, 2004: View of drywall damage at interior utility chase.

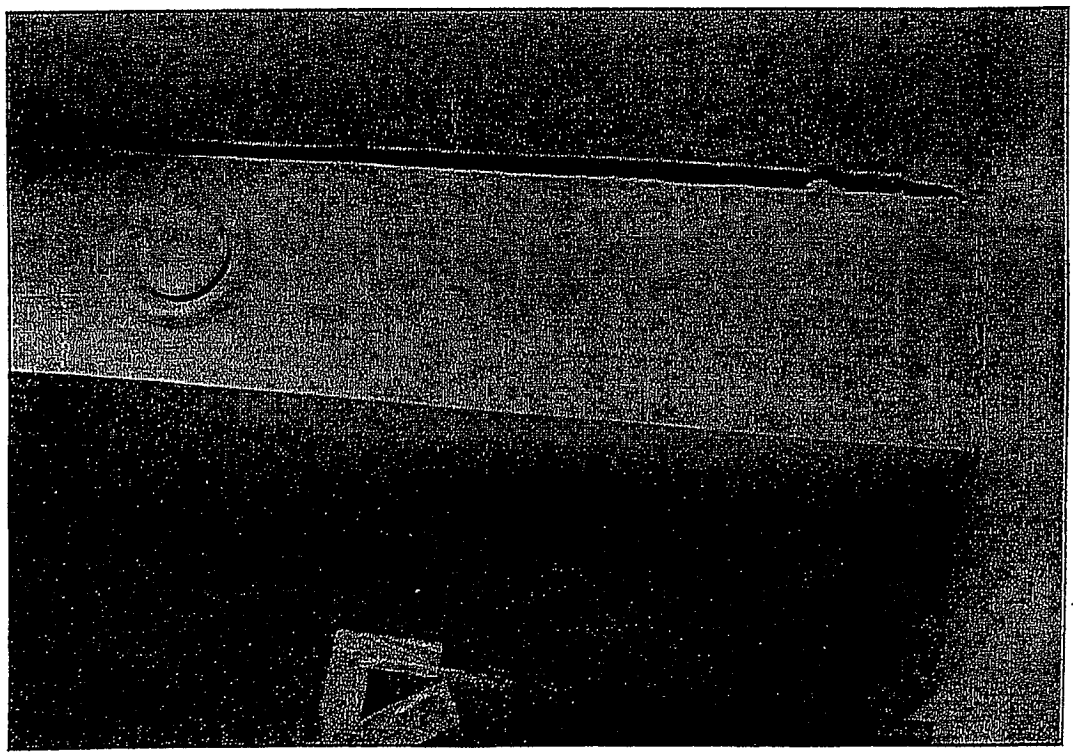


PHOTO 2. March 25, 2005: View of drywall damage at interior utility chase.

PHOTO 3. October 14, 2004: Arctic pipe enclosure damage (note large gap above top of pipes).

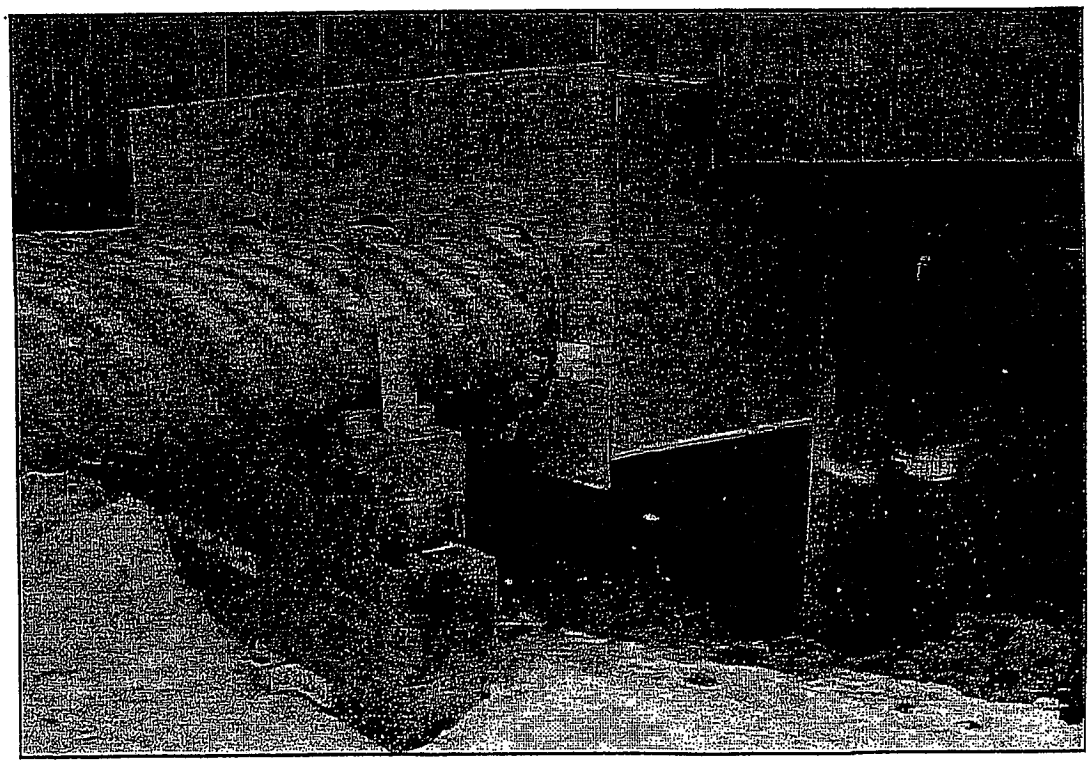


PHOTO 4. March 25, 2005: Arctic pipe enclosure damage (note large gap below bottom of pipes).

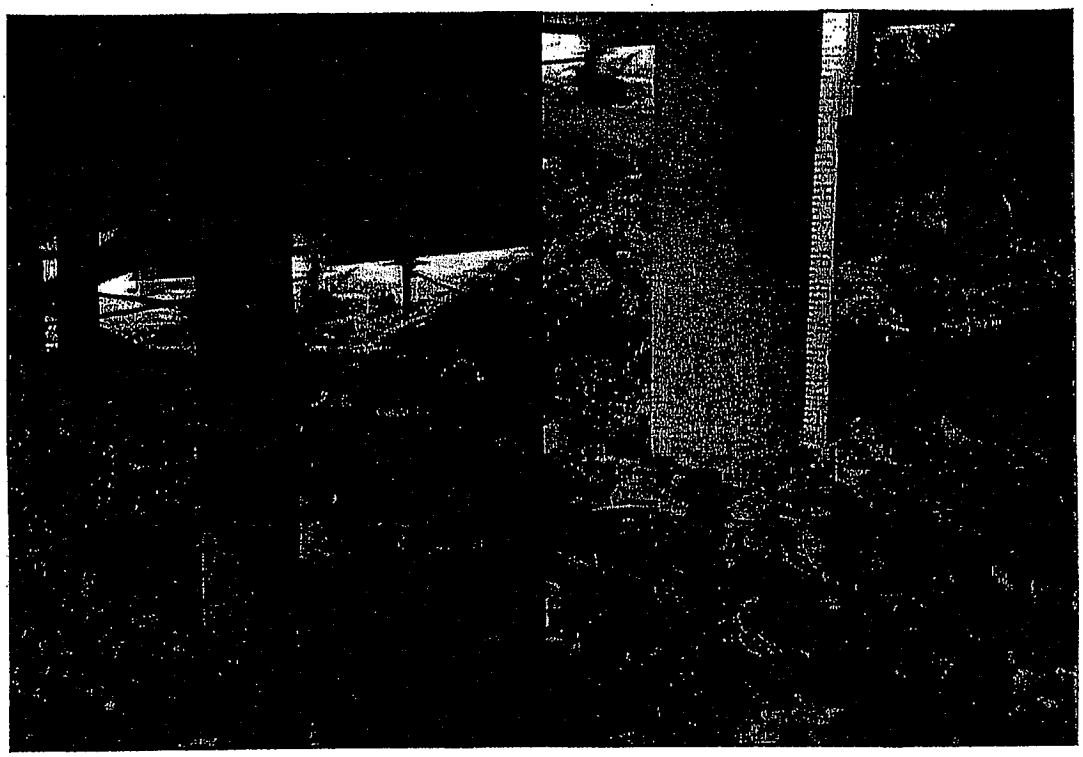


PHOTO 5. October 14, 2004: Seasonal ground movement comparison (note height of cross-bracing above ground).

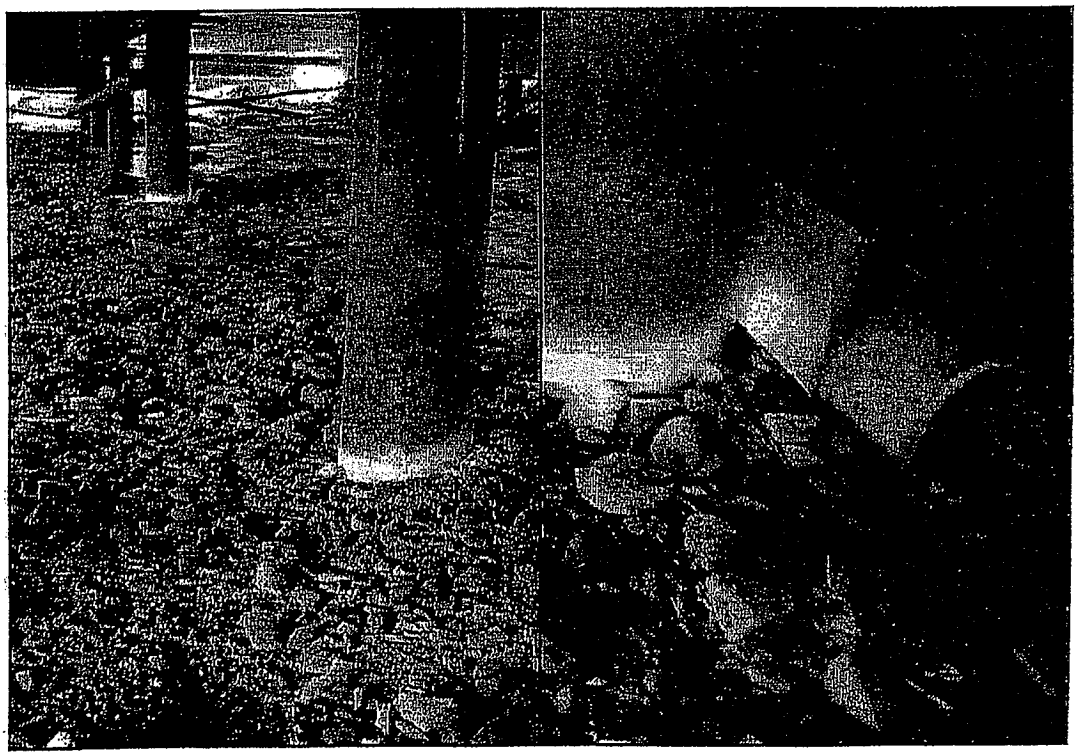


PHOTO 6. March 25, 2005: Seasonal ground movement comparison (note height of cross-bracing above ground).

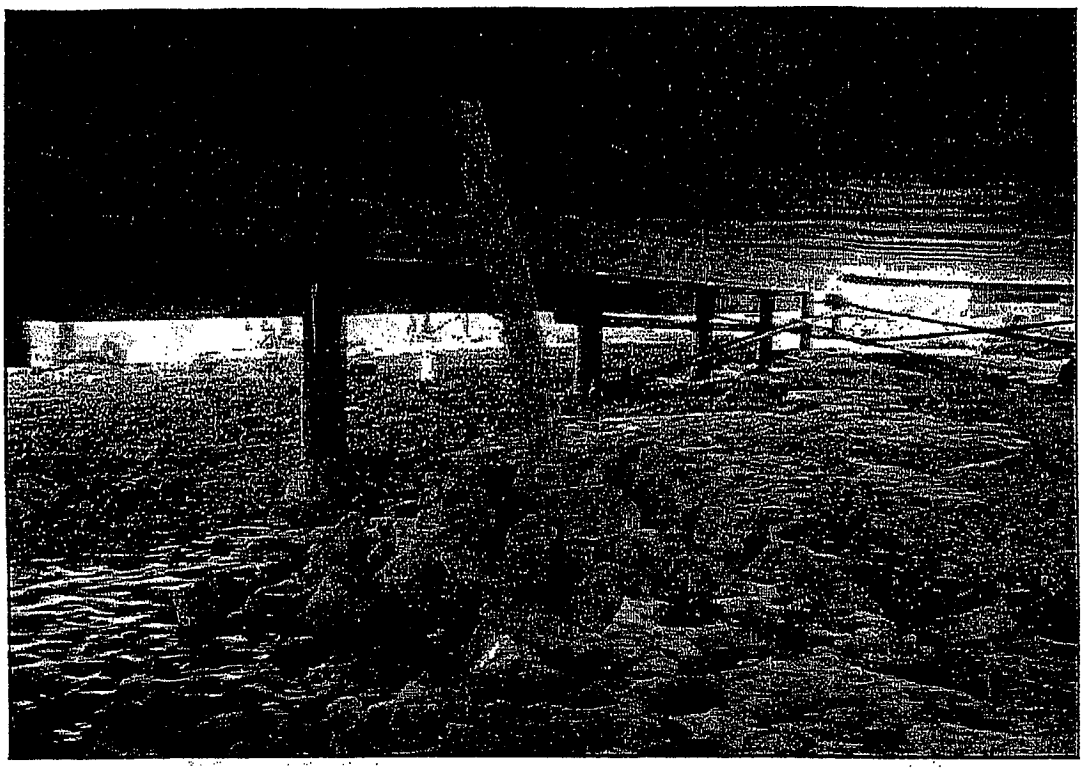


PHOTO 7. March 25, 2005: 4"x4" timber damage to building envelope beneath northeast area of washeteria.

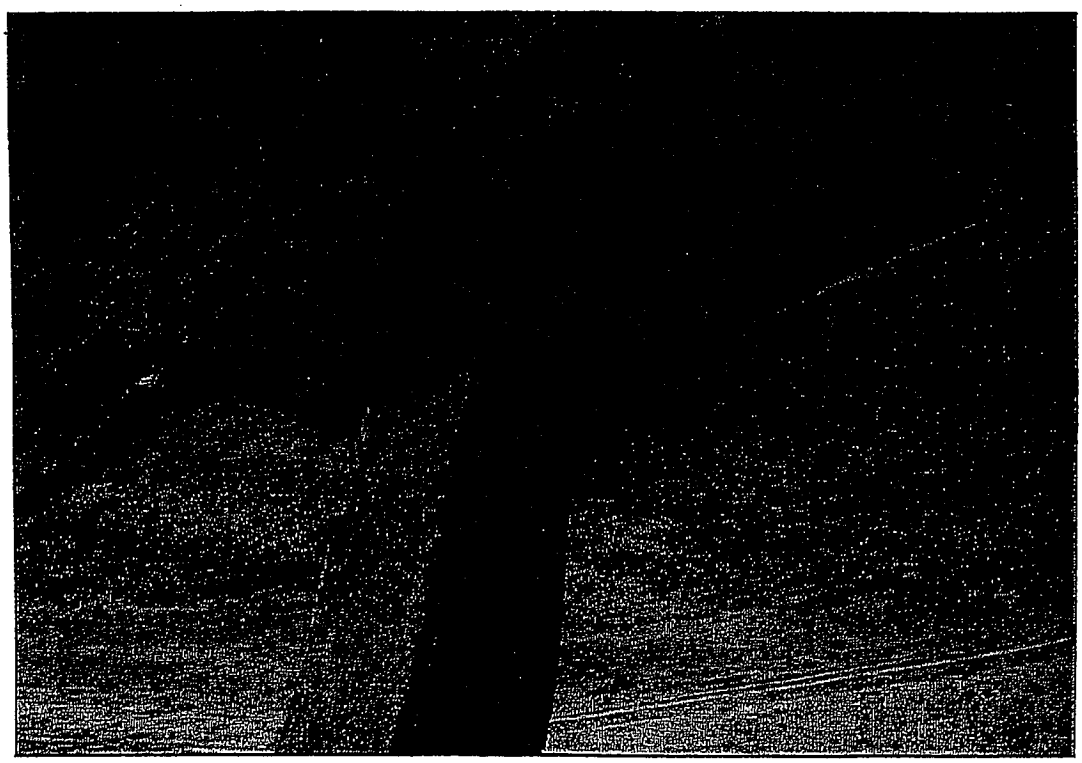


PHOTO 8. March 25, 2005: 4"x4" timber damage to building envelope beneath northeast area of washeteria.

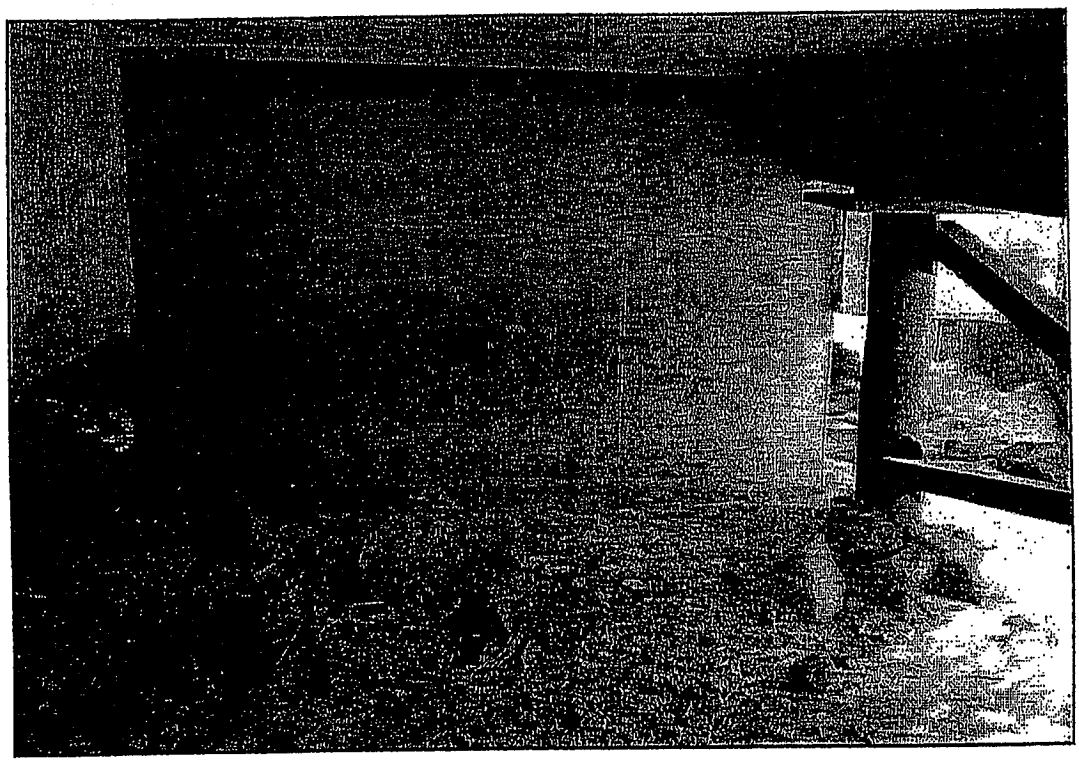


PHOTO 9. March 25, 2005: View of west side of utility enclosure in contact with ground and ice.

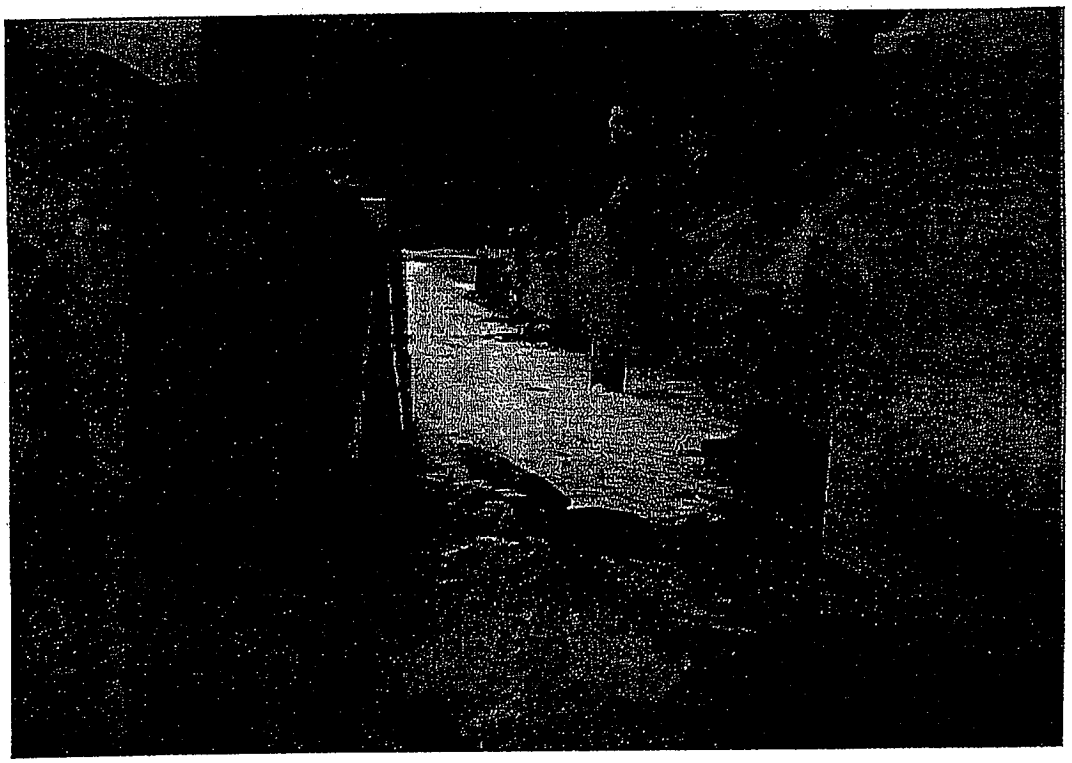


PHOTO 10. March 25, 2005: View of south utility enclosure (right) and arctic pipe support (left) in contact with ground.

ENGINEERING DESIGN & CONSULTING
An Alaskan Owned Professional Corporation

EDC, INC.
213 W. Fireweed Lane
Anchorage, AK 99503

March 30, 2005

Greg Magee
Village Safe Water
555 Cordova Street
Anchorage, AK 99501

Subject: Emmonak Washeteria – Site Inspection Trip Report

Dear Greg:

Per your request, Kevin Hansen and I traveled to Emmonak, Alaska on March 25, 2005 with Cindy Roberts of the Denali Commission, Brian Shumaker of Duane Miller & Associates and yourself. The purpose of the trip was to inspect and document the current condition of the new washeteria building's mechanical and electrical systems. We noted any code violations and any mechanical or electrical system operational problems. This report summarizes our findings and presents recommendations on how to correct the deficiencies.

EXECUTIVE SUMMARY

The installation of the electrical systems in the washeteria was poorly done. There are numerous violations of the National Electrical Code (NEC) throughout the facility that present potential safety as well as fire hazards. These hazards do not appear imminent. However, until they are corrected, the building should remain locked from the public with only the minimum of circuits energized to maintain building heat and lighting.

The mechanical systems in the washeteria have serious defects, including fire hazards. A number of violations of Uniform Plumbing Code (UPC), International Fire Code (IFC), and International Mechanical Code (UMC) exist. The system design was inadequately presented on the drawings, and installation was deficient. The heating system cannot deliver heat to the loads properly due to improperly sized piping, circulation pumps, and possibly boilers. The control systems do not operate automatically and create a potential for further freezing damage to the building systems.

The problems that are present are the result of improperly qualified and supervised personnel performing the installation without properly prepared engineering drawings. Drawings that specify the proper requirements and necessary changes should be developed. Properly qualified tradesmen and administrators should then be hired to perform the work to correct the problems under the supervision of the design engineers.

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ELECTRICAL FINDINGS

GENERAL:

The washeteria has a 200A, 120Y208V, three-phase, 4-wire electrical service. The service is supplied overhead from a bank of three, 15kVA, pole-mounted transformers. There is a 200A rated meter/main device on the outside of the building. It feeds a 200A rated, three-phase, 42-space, main panelboard located in the mechanical room. This panel in turn feeds two sub-panels, one for the dryers and one for the washers. They are both 200A, three-phase, 30-space panelboards.

With the exception of the feeders to the sub-panels, all the branch circuits originating in the main panelboard are of the non-metallic sheathed cable (romex) type. The sub-panel feeders consist of wiring in EMT conduit. All the branch circuits originating in the washer and dryer panelboards consist of THHN wiring in EMT conduit.

The lighting throughout the building is predominately of the fluorescent type with four-foot, T-8 lamps. There are a few incandescent type fixtures in the washer and dryer mechanical access rooms, the bathrooms and on the outside of the building entrances. Convenience receptacles are located throughout the building. GFCI protection is provided for most, but not all of the receptacles that are required by the NEC to have this protection.

CODE VIOLATIONS:

The following lists many of the NEC code violations that were noted during the inspection. This is not a complete list and there are likely additional code violations that were missed.

1. Building Ground – the main grounding electrode conductor appears to be undersized. A minimum of a #4 AWG copper conductor is required. This conductor should be bonded to at least one of the foundation piles. It does not appear that this was done.
2. Meter/main disconnect – the meter/main device should have a rain-tight hub at the service riser connection. There is no separate neutral bus or main bonding jumper. The phase conductors of the feeder to the main panelboard are different sizes and only one appears to be of the correct size. They should all be at least #3/0 AWG for a 200A service. The size could not be determined because the insulation on the conductors was damaged during installation and the markings were gone. These conductors should have been color-coded and installed in a raceway with bonding bushings. This was not done. A separate green equipment grounding conductor should also have been included with these conductors.
3. Main panelboard – The ground and neutral busses are tied together. The phase 'A' bus and main terminal connection show damage from arcing. None of the feeder or branch circuit conductors are properly color-coded. There is water piping routed directly above the panelboard. There is not proper clear-space in front of the panelboard. There are open conduit knockouts in the top of the panelboard. The three-pole branch circuit breaker for the dryer sub-panel is

covered with paint splatter. The panelboard schedule is partially unreadable and the circuits are not clearly defined.

4. Feeders to the washer and dryer sub-panels - The conduits for the sub-panel feeders require bushings at the panel connections. The insulation on these feeders was damaged as a result of not provided these bushings. The phase conductors for the feeder to the washer sub-panel are routed in two separate conduits. This is also true of the dryer sub-panel feeder. Only two phase conductors are routed to the dryer sub-panel from the three-pole circuit breaker. Neither feeder includes a green equipment grounding conductor.
5. Washer & Dryer Sub-panels – Neither panel has the proper clear-space. The branch circuit conductors are not properly color-coded. The dryer panel has numerous open circuit breaker spaces in its cover. It is also inherently unbalanced since phase 'B' is not connected. The ground and neutral busses in both sub-panels are tied together. The ampacities of the branch circuit conductors in the washer sub-panel are exceeded because of the de-rating required due to number of conductors in a conduit.
6. Branch circuits – The conduits for numerous branch circuits are not properly supported. In many cases, aluminum strapping or 'plumber's tape' was used to secure the conduit instead of the appropriate conduit straps. A few of the liquidtight conduit connections at the dryers are separating from the ceiling box due to excessive tension. In the boiler room, a conduit was routed directly underneath a ceiling mounted fluorescent light fixture. Numerous junction boxes are over-filled, have missing covers and/or have open knockouts. The convenience receptacle near the sink in the main laundry area should have GFCI protection. So should all the receptacles in the shower/bathrooms. The light in the women's bathroom is on the receptacle circuit. It turns off when the bathroom GFCI receptacle is tripped. Liquidtight nonmetallic conduit is used to connect to the extractors. This type of conduit is not allowed due to the potential abuse to which it might be subjected. The wall switches for the hot water circulation pump; dryer heat circulation pump, boilers and water heater circulation pump are not labeled and are easily confused as light switches.
7. Miscellaneous – Time did not allow for a complete investigation of all the circuits, junction boxes and devices. It is highly likely that there are additional code violations due to overfill of boxes and conduits; improper wiring and conduit terminations; improper grounding and bonding of boxes and devices, and improper wiring methods and identification.

NON-CODE ISSUES:

The following items are not code violations, but are undesirable as noted:

1. Each stackable dryer requires only a single 15A circuit that serves both the upper and lower dryer. Currently, there are two 15A circuits run to each stackable

dryer, one for the upper and one for the lower. This doubles the amount of circuits and circuit breakers that are necessary.

2. The majority of the building mechanical and dryer controls are manual. This results in inefficient and potentially dangerous operation. See the mechanical report for further discussion.
3. The lighting in the dryer and washer mechanical access rooms is inadequate. Additional lighting should be added.
4. The incandescent fixtures tend to have a short life and are not very efficient. High-pressure sodium fixtures for the exterior and fluorescent fixtures for the interior are generally preferred.
5. The lack of design and As-built drawings will make future maintenance and troubleshooting difficult.

MECHANICAL

GENERAL:

The boiler system consists of two boilers on a common supply header serving three pumped zones: dryers, water heating, and building heat. It is apparent that the boiler system was not engineered, and the pumps and piping system are woefully inadequate to carry the load. The boilers may also be too small, based on rough estimates. Pumps are located on the return of each zone and pump into the boiler return header. The boiler headers do not have flow balancing valves to direct the appropriate flow through the differently sized boilers. The single expansion tank is located on the supply header, and with the pumps located on the return, the boiler pressure will vary depending on the number of pumps running at any time. It may also be possible for the system pressure to drop below atmospheric pressure near the pump suction. Only a single manual air vent is installed on the piping, and air noise in the system was noted during the visit. The boiler system is connected to the domestic water system through a check valve and pressure regulator, and the system is currently filled with water. There is no provision for adding glycol solution to the system.

The building ventilation system consists of a Fantech heat recovery ventilator that exhausts air from the toilet and shower rooms and supplies ventilation to the remainder of the building. The unit transfers heat from the exhaust system to the ventilation to reduce the heat loss and infiltration.

The building plumbing system is fairly conventional with drainage connected to a vacuum sump. Water supply is from the piped distribution system with a recirculation line and pump located inside the building. Only a limited amount of the plumbing piping was visible during our visit, having been concealed within the floor and walls.

CODE & SAFETY DEFICIENCIES

The following lists code violations noted during the inspection. Other code violations may exist as it was not possible to observe the portions of the system that were concealed.

1. The fuel storage tank is too close to the building. The IFC required distance is 5 feet minimum. The normal vent is incorrectly installed. It is required to extend 12 feet above grade. No emergency vent is installed on the tank as required by IFC. Plastic shipping plugs are installed in tank tappings. The supply piping is rigidly connected between the tank and the building. A flexible connection is required to prevent breakage or loosening of joints due to differential movement per IMC. A level gauge is required on the fuel tank per IMC.
2. Boiler Stack clearances to combustibles are inadequate. The horizontal portion of the boiler vent connector is within 12 inches of the ceiling while IMC requires at least 18 inch clearance to combustibles for single wall vent connectors. In addition, piping and pipe insulation is routed within a few inches of the vent connector. Either protection for the combustibles needs to be installed to reduce the required clearance to 9 inches or the single wall vent connectors replaced with double wall pipe with reduced clearance-to-combustible requirements. In any case, the combustible pipe insulation must be relocated outside the required stack clearance space.
3. The boiler stack system has inadequate rise, spilling combustion products into the room from the barometric damper when the burner fires. Both boilers are connected to the same stack, and the connecting tee is undersized. The boiler vent dampers are fully open, indicating that the boilers were not set up for proper over-fire draft and burner adjustments.
4. The relief valve on the larger boiler is rated at 510,000 BTUH capacity, but the boiler is rated at 634,000 BTUH. It is apparent that the relief valves were installed on the incorrect boiler as the valve on the smaller boiler (396,000 BTUH) has a capacity of 925,000 BTUH, which would be adequate for the larger boiler.
5. Inadequate combustion air is supplied to the boiler room. A single 16 inch square vertical duct with a 12" x 18" wall louver is provided. IMC requires two openings, each sized based on the total input rating of the boilers. The installed louver provides inadequate free opening (estimated at less than 40% of the louver size).
6. The water heater uses boiler water to heat potable domestic water, but is a single wall unit. When the boiler system is filled with glycol, there is a possibility of contaminating the potable water system with glycol if the heat exchange surface leaks. A double wall water heater is required by the Uniform Plumbing Code (UPC) when used with glycol boiler solution.
7. The water heater is inadequately braced. UPC requires seismic bracing of water heaters consisting of straps at the upper and lower 1/3 of the height. A single light

gauge sheetmetal strap is installed at the mid-height of the unit. No bracing is installed on the hot water storage tanks.

8. Traps and hot water supplies on the lavatories and service sink are uninsulated. Insulation is required on fixtures accessible to the public to prevent injury.
9. The boiler control panel has both 120V and low voltage control wiring in the same conduit, a violation of the National Electric Code. Building thermostat wiring is routed alongside heating piping under the insulation, where is will likely be damaged by heat.
10. The drain trap arm for the service sink is too long. The trap arm is approximately 8 ft long, while UPC requires no more than 3 feet 6 inches between the trap and the vent for a 1-1/2" drain.
11. The ventilation intake is located closer than 10 feet from the toilet room exhaust outlet in violation of the IMC.

Operational Deficiencies:

1. The boilers may be undersized and incapable of carrying all ten dryers, the dryer make-up air coil, building heat, and water heating under winter design conditions. The estimated loads are 400 MBH for dryers, 400 MBH for dryer make-up air, 100 MBH for building heat, and over 200 MBH for water heating, with an estimated total in excess of 1100 MBH versus a total boiler capacity of 1040 MBH.
2. The boiler system is currently filled with water, and no provisions for filling with glycol solution are provided. The system (especially the dryer make-up air coil) is vulnerable to freezing if not protected with glycol.
3. The inlet damper for the dryer make-up air coil does not operate, so no air can reach the dryer inlets except through leakage through the damper and through other building openings. This will also make the building susceptible to freeze damage from that infiltration. The motor may be burnt out.
4. The dryer make-up air coil was designed to heat outside air from minus 40 F to 65F using 40 gpm of heating glycol per the order placed with the supplier. The piping connections on the coil are 2 inch copper, but the coil was supplied with only 3/4" pipe, which can reasonably carry only about a tenth of the required flow. Unless the pipe size is increased and the flow increased to the design, the coil will be unable to adequately heat the incoming air.
5. The circulating pump serving the dryer coils and make-up air coil is undersized. The dryer coils require 3 gallons per minute for each coil with a pressure drop across each coil of 10 ft of water, for a total flow of 6 gpm per dryer. With ten dryers installed the required flow rate is 60 gpm for the dryers alone. The dryer make-up air coil requires another 40 gpm, although the 3/4" pipe supplying it

cannot carry that flow. The installed pump, an Armstrong Model S-35BF, is rated to deliver approximately 35 gpm at about 9 ft of head, when approximately 100 gpm at an estimated 30-40 ft of head is needed.

6. The circulating pump serving the water heater is oversized for the application. The Taco 1600C pump supplies approximately 40 gpm with only 20 gpm required at the water heater.
7. The circulating pump serving the building heating loop is improperly sized. The entire loop is served by 3/4" copper tubing, which has a capacity of 4 to 5 gpm, while the pump (Armstrong Model S-35BF) has a nominal flow rating of 35 gpm at about 9 feet of head.
8. The building heating loop consists of two zones, one for interior space heating and one for below floor pipe chase heating. Both zones operate on a single thermostat, which is located within the building. This creates a potential for the building thermostat to be satisfied while the underfloor space is freezing. Both zones are served by a single pump, and its failure puts the building in jeopardy of freezing.
9. Controls for the dryer and water heater circulation pumps are manual, with switches located in the dryer plenum and boiler room, respectively. This method of control is not energy efficient and depends on an operator to manage the system. A boiler controller for the building heat is provided in the mechanical room, but the water heater thermostat is not connected to it. The boilers operate on individual boiler mounted temperature controls with no provision for outdoor temperature reset or dryer/water heater temperature override.
10. The boiler expansion tank is undersized. The use of an undersized expansion tank will cause the boiler relief valves to open as pressure builds.
11. The facility has been allowed to freeze, and a number of burst pipes need repair. The building water supply inside the building near the sewage lift station has a burst pipe and a burst pressure regulator. Nearly all of the shower solenoid valves are broken from freezing damage and many of the valves have female threaded plastic couplers connections which are prone to splitting. Both the hot water and cold water mains inside the plumbing chase behind the men's shower room have burst.
12. The ventilation unit controller does not appear to control the unit. The control does not stop or start the supply fan. The switch on the unit appears to start only the exhaust fan.
13. There are no identification markings on piping, valves, pumps, or controls.

RECOMMENDATIONS

A set of properly engineered mechanical and electrical drawings should be developed that specify the correct installation requirements and detail the modifications required to correct the code violations and operational problems noted above. Appropriately licensed and trained trade and supervisory personnel should then be enlisted to perform the modifications in accordance with these drawings as verified by the design engineers.

ELECTRICAL

The recommended modifications to the electrical systems as listed below correspond to the enumerated violations shown above.

1. Building ground – Provide the correct size grounding conductor and bond to the nearest building pile.
2. Meter/main disconnect – Provide a rain-tight hub, neutral bus and bonding jumper. Remove the existing feeder to the main panelboard. Provide a new correctly sized and color-coded feeder with equipment grounding conductor routed in galvanized rigid conduit with bonding and insulating bushings.
3. Main panelboard – Remove the bonding jumper between the ground and neutral busses. Replace the phase 'A' main terminal and clean or replace the phase 'A' bus. Properly color-code the branch circuit conductors and clearly identify each circuit on the panel schedule. Re-route the water piping above the panel and rotate the circulation pump below the panel so that the appropriate clear-space can be achieved. Fill all the unused conduit knockouts with plugs. Remove the three-pole breaker serving the dryer sub-panel.
4. Feeders to the washer and dryer sub-panels – Remove completely the feeders between the main panelboard and the washer and dryer sub-panels. This includes all conduit and wiring. The feeder to the washer sub-panel should be replaced with correctly sized and color-coded conductors (including equipment ground) routed in a single conduit. Provide the proper conduit bushings. The feeder to the dryer sub-panel will not be replaced since this panel is to be removed.
5. Washer & Dryer Sub-panels – The dryer sub-panel is to be removed and the dryer circuits are to be re-served from the main panelboard. This will eliminate the clear-space problem with this panel. It will require five new circuits to be routed from the main panelboard to the five stackable dryers. This will also resolve the issue of the double circuits currently run to the dryers. The piping in front of the washer sub-panel should be re-routed to achieve the appropriate clear-space for this panel. Remove the bonding jumper between the ground and neutral busses on this panel. Re-route the washer circuits to avoid exceeding the conductor ampacities. Provide the appropriately colored branch circuit conductors.
6. Branch circuits – Properly support all conduits using the proper conduit straps. Re-route conduit under fixture in boiler room. Provide GFCI receptacles for the

laundry sink and in the bathrooms. Re-wire the light in women's bathroom from the receptacle circuit to a lighting circuit. Provide liquidtight metallic conduit for connection to the extractors. Provide clear labels for all pump switches. Provide plugs in all empty junction box knockouts, repair damaged liquidtight conduit connections and re-route circuits as necessary to avoid conduit or junction box overfill.

7. Miscellaneous – Inspect all junction boxes, devices and equipment connections for proper terminations, grounding, bonding and installation. Make corrections as necessary.
8. Additional recommendations include providing automatic controls for the building heating and dryer systems (see mechanical), providing additional lighting in the washer and dryer mechanical access rooms, and replacing the incandescent fixtures with fluorescent or high-pressure sodium.

MECHANICAL

Corrections corresponding to the code and safety deficiency listing above.

1. Relocate the tank at least 5 feet from the building per International Fire Code (IFC) requirements. Install the normal vent at 12 feet above grade. Install an approved emergency vent. Replace plastic plugs with properly sealed metallic plugs. Install an approved flexible connection in the supply piping between the tank and the building.
2. Boiler Stack – Either install protection for the combustibles to reduce the required clearance to 9 inches or replace the single wall vent connectors with double wall pipe with reduced clearance-to-combustible requirements. In either case, the combustible pipe insulation must be relocated outside the required stack clearance space.
3. Boiler stack – Revise the venting system to eliminate the barometric dampers and provide gas-tight joints to avoid flue gas contamination inside the building. The venting material must be coordinated with the required clearance-to-combustibles as noted above. On completion of revisions to the venting system the boilers should be properly adjusted.
4. Boiler Relief Valve – It is apparent that the relief valves were installed on the incorrect boiler as the valve on the smaller boiler (396,000 BTUH) has a capacity of 925,000 BTUH, which would be adequate for the larger boiler. Install the correct relief valves.
5. Combustion air – Provide required combustion air, including a screen or louver properly sized to provide the required open area.
6. Water heater – Replace the water heater with a double wall water heater.

7. Water heater bracing – Provide proper bracing for water heater and hot water storage tanks.
8. Provide insulation for traps and hot water supply on lavatories and service sink.
9. Boiler Control Panel – Provide a boiler control panel with wiring per NEC. Reroute thermostat wiring away from heated piping.
10. Service Sink Vent – Relocate the vent closer to the trap to meet IPC requirements.
11. Ventilation intake – Relocate the intake or exhaust for 10 ft separation per IMC requirements.

OPERATIONAL DEFICIENCY RECOMMENDATIONS

The following listing refers to the Operational Deficiencies listed above

1. Boiler Capacity – Recheck boiler loads and provide additional capacity or load limiting as required.
2. Glycol solution – Provide a glycol fill system and fill the heating system with 50% propylene glycol solution.
3. Dryer Inlet Air Damper – Determine the cause of the inoperable damper and repair.
4. Dryer Make-up Air Coil – Install correctly size piping to the coil.
5. Dryer Loop Circulating Pump – Calculate flow and head for proper pump selection and replace the existing pump if required
6. Water Heater Circulating Pump – Calculate flow and head for proper pump selection and replace the existing pump if required.
7. Building Heating Loop Circulating Pump – Replace the existing single circulating pump with properly sized duplex pumps.
8. Building Heating Loop Zones – Reconfigure the building heating loop for individual control of the interior and below floor heating.
9. Dryer and Water Heater Circulation Pump Controls – Design and install a coordinated control system incorporating a boiler controller such as manufactured by Tekmar. The system should include automatic start/stop control for dryer and water heater pumps, as well as outdoor reset of boiler temperature and priority override for dryers and water heater.
10. Boiler Expansion Tank – Install an expansion tank properly sized for the system volume.
11. Repair burst pipes as necessary. Replace the shower solenoid valves and install them with proper adapter fittings.

12. Ventilation Unit Controller – Troubleshoot and repair as required.
13. Provide identification marking on piping, valves and controls.

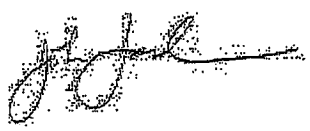
OTHER RECOMMENDATIONS

1. The trap and water supply on the water fountain should be concealed to prevent potential damage.
2. The vertical portion of the water piping mains in the chase behind the washers is installed tight to the structure. The holes should be relieved to allow some movement on expansion and contraction of the piping to prevent binding.
3. Coil fins on the dryer plenum coil need to be straightened.
4. Piping insulation is poorly applied and the insulation type is unsuitable for heating piping. It has a tendency to harden and break over time. Many lengths of pipe have the incorrect size insulation installed. The insulation is not secured in place and joints at fittings have gaps. Recommend that semi-rigid fiberglass pipe insulation with All-Service jacket and fitting covers be installed.
5. Dryer coil inlet filters are damaged and should be replaced.
6. Dryer coil fins need to be straightened.
7. Piping to the dryer coils has unions that are inaccessible, making maintenance more difficult than if the unions were located where they could be disconnected.
8. No exhaust air grille is installed in the sewage sump room. A number of supply grilles need to be reinstalled.
9. The fintube cover in the men's toilet room is damaged and should be replaced.

Once the repairs have been accomplished a set of As-built drawings should be prepared based on mark-ups of the design drawings that were generated as the repairs were made.

Please feel free to contact us if there are any questions concerning this report.

Sincerely,



John Faschan, P.E.

EDC, INC.